NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS)

OPERATIONAL ALGORITHM DESCRIPTION DOCUMENT FOR VIIRS VEGETATION INDEX EDR SOFTWARE (D36951 Rev A)

CDRL No. A032

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Revision/Change Record

Document Number D36951

Revision	Document Date	Revision/Change Description	Pages Affected
---	4-30-03	Initial Release.	All
A1	12-4-03	Updated to reflect Science To Operational Code Conversion.	All
A2	4-20-05	Reflects NGST comment corrections plus inserted new logo and updated upper right header date, title/signature page dates, Revision/Change Record.	All
A3	6-15-05	Reflects additional comments posted on 19Apr05 to the eRoom "Post-Sci2Ops OAD Review Comments" site.	All
A4	7-1-05	Under Section 1.3.3, Source Code and Test Data References, inserted a more detailed table listing paths to find applicable source code within the ClearCase configuration management tool.	Pg 2
A5	7-12-05	Per Dan Antzoulatos' request, changed the wording of information added by the 01 Jul 2005 Revision/Change Record line.	Pg 2
A6	6-15-07	Logo, cleanup updates. Delivered to NGST.	All
A7	12-10-07	ECR A-103, EDRPR 1.8 CP 3 updates -Format changes for CDFCB-X compliance- removed Table 5. Granule Level Quality Flag Structure. Output section tables have been updated.	All
A8	1-4-08	Reformatted to new template. Updated in response to comments from NGST. Tech Memo NP-EMD-2006.510.0042 implemented. Prepared for delivery to NGST.	All
A9	1-8-08	ECR A-103 Action Item updates to add Datatype field in Table 4. VVI Output Contents.	All
A10	6-12-08	Updated data quality monitoring section. Implemented tech memo NP-EMD.2008.510.0006_NPP_Cirrus_flag_testing_update_for_Vegetation_Index.	10
A11	10-29-08	Prepared for TIM/ACCB.	All
A	12-17-08	Addressed TIM/ACCB comments. Incorporates ECR A-177A. Approved for Public Release per Contracts letter 090618-01.	All

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1.0 INTRODUCTION

1.1 Objective

The purpose of the Operational Algorithm Description (OAD) document is to express, in computer-science terms, the remote sensing algorithms that produce the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) end-user data products. These products are individually known as Raw Data Records (RDRs), Temperature Data Records (TDRs), Sensor Data Records (SDRs) and Environmental Data Records (EDRs). In addition, any Intermediate Products (IPs) produced in the process are also described in the OAD.

The science basis of an algorithm is described in a corresponding Algorithm Theoretical Basis Document (ATBD). The OAD provides a software description of that science as implemented in the operational ground system --- the Data Processing Element (DPE).

The purpose of an OAD is two-fold:

1. Provide initial implementation design guidance to the operational software developer
2. Capture the “as-built” operational implementation of the algorithm reflecting any changes needed to meet operational performance/design requirements

An individual OAD document describes one or more algorithms used in the production of one or more data products. There is a general, but not strict, one-to-one correspondence between OAD and ATBD documents. This particular document describes operational software implementation for the Visible/infrared Imager/Radiometer Suite (VIIRS) Vegetation Index (VI) Environmental Data Record (EDR).

1.2 Scope

The scope of this document is limited to the description of the core operational algorithms required to create the VIIRS VI EDR. It provides a general overview and is intended to supplement in-line software documentation and interface control documentation for maintenance of the operational software. The theoretical basis for this algorithm is described in Section 3.3 of the VIIRS Vegetation Index (VVI) Algorithm Theoretical Basis Document (ATBD), D43757.

1.3 References

1.3.1 Document References

The science and system engineering documents relevant to the algorithms described in this OAD are listed in Table 1.

Table 1. Reference Documents

Document Title	Document Number/Revision	Revision Date
VIIRS Vegetation Index (VVI) Algorithm Theoretical Basis Document (ATBD)	D43757 Rev. ---	24 Jan 2007
VIIRS Vegetation Index Unit Level Detailed Design	Y2499 Ver. 5 Rev. 4	May 2003
VIIRS Radiometric Calibration Algorithm Theoretical Basis Document (ATBD)	D43777 Rev. B	26 Mar 2008
VIIRS Radiometric Calibration Component Detailed Design Document	Y2490 Ver. 5 Rev. 4	30 Sep 2004
VIIRS Algorithm Verification Status Report	D36812 Rev. 2.04	2 Dec 2003

Document Title	Document Number/Revision	Revision Date
VVI Science Grade Software Unit Test Document	D36950 Rev. A	10 Oct 2008
NPOESS Calibration/Validation Plan	D34484 Draft Version 3.0	17 Dec 2002
NPOESS EDR Performance Report	NPOESS.02.520.010 Ver. 3.3	2 Feb 2002
NPP EDR Production Report	D37005 Rev. C	16 Mar 2007
EDR Interdependency Report	D36385 Rev. C	7 Nov 2007
NPP Mission Data Format Control Book (MDFCB)	GSFC 429-05-02-42 R1	14 Apr 2006
CDFCB-X Volume I - Overview	D34862-01 Rev. B	27 Aug 2007
CDFCB-X Volume II – RDR Formats	D34862-02 Rev. B	27 Aug 2007
CDFCB-X Volume III – SDR/TDR Formats	D34862-03 Rev. A	27 Aug 2007
CDFCB-X Volume IV Part 1 – IP/ARP/GEO Formats	D34862-04-01 Rev. A	10 Sep 2007
CDFCB-X Volume IV Part 2 – Atmospheric, Clouds, and Imagery EDRs	D34862-04-02 Rev. A	10 Sep 2007
CDFCB-X Volume IV Part 3 – Land and Ocean/Water EDRs	D34862-04-03 Rev. A	10 Sep 2007
CDFCB-X Volume IV Part 4 – Earth Radiation Budget EDRs	D34862-04-04 Rev. A	10 Sep 2007
CDFCB-X Volume V - Metadata	D34862-05 Rev. B	27 Aug 2007
CDFCB-X Volume VI – Ancillary Data, Auxiliary Data, Reports, and Messages	D34862-06 Rev. C	10 Sep 2007
CDFCB-X Volume VII – Application Packets	D34862-07 Rev. ---	10 Sep 2007
NPOESS EDR Synergisms and Fusion Summary	D34837	20 Feb 2002
NPOESS IDP Segment Central Specification	SY10-0003 Rev. N	21 Sep 2007
NPOESS Modeling and Simulation Plan	D34475 Ver. 1.0	15 Mar 2002
NPOESS Scene Generation Development Report	D34861 Ver. 1.0	11 Feb 2002
NPOESS Software Development Plan	D31417-01 Rev. A	31 May 2005
NPOESS Software Development Plan - Addendums	D31417-02 Rev. A	31 May 2005
NPOESS Software Development Plan Annex: Software Metrics Plan	D31417-03 Rev. A	31 May 2005
NPOESS Subcontract Management Plan	D34845 Ver. 1.0	18 Feb 2002
NPOESS System Specification	SY15-0007 Ver. M	18 Oct 2007
NPOESS System Test Plan	D31406 Rev. C	6 May 2005
NPP Command and Telemetry (C&T) Handbook	568423 Rev. A	5 Apr 2005
VIIRS Science Algorithm 2.2.1 Data Delivery to IDPS Package Version Description (PVD)	D45109 Rev. ---	20 Aug 2007
Data Processor Inter-subsystem Interface Control Document (DPIS ICD)	D35850 Rev. U.2	27 Aug 2008
D35836_G_NPOESS_Glossary	D35836_G Rev. G	10 Sep 2008
D35838_G_NPOESS_Acronyms	D35838_G Rev. G	10 Sep 2008
NGST/SE technical memo – NPP_VIIRS_VI_EVI_Range	NP-EMD-2006.510.0042	28 June 2006
NGST/SE technical memo – _Cirrus_flag_testing_update_for_Vegetation_Index	NP-EMD.2008.510.0006	18 Jan 2008
Operational Algorithm Description Document for VIIRS Surface Reflectance IP	D38697 Rev. A	10 Dec 2008

1.3.2 Source Code References

The science and operational code and associated documentation relevant to the algorithms described in this OAD are listed in Table 2.

Table 2. Source Code References

Reference Title	Reference Tag/Revision	Revision Date
VIIRS VVI Unit Test Data	ISTN_VIIRS_NGST_2.2	30 May 2003
VIIRS Vegetation Index (VVI) science-grade software	ISTN_VIIRS_NGST_2.2	30 May 2003
VIIRS Vegetation Index (VVI) operational software	B1.5.X.1	Dec 2007
_Cirrus_flag_testing_update_for_Vegetation_Index	NP-EMD.2008.510.0006	18 Jan 2008

2.0 ALGORITHM OVERVIEW

The VIIRS Vegetation Index (VVI) consists of two vegetation indices--Normalized Difference Vegetation Index (NDVI) from top-of-atmosphere (TOA) reflectances and Enhanced Vegetation Index (EVI) from top of canopy (TOC) reflectances. These indices are produced at the VIIRS image channel resolution (i.e. nominally 375m at nadir).

The VIIRS Vegetation Index EDR is computed after the RDR, SDR, and intermediate products processing is complete. The processing relationship is illustrated in Figure 1 below.

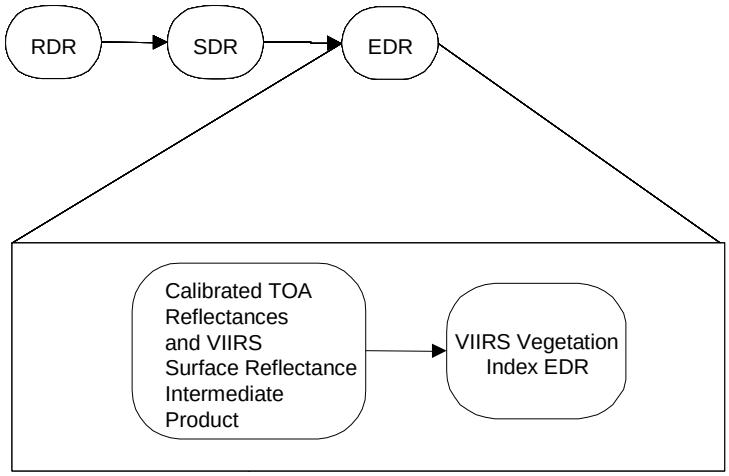

Figure 1. Processing Chain Associated with VIIRS Vegetation Index EDR

2.1 Algorithm: Vegetation Index Environmental Data Record Description

2.1.1 Interfaces

To begin processing the data, the Infrastructure (INF) Software Item (SI) initiates the VIIRS Vegetation Index algorithm. The INF SI provides tasking information to the algorithm indicating which granule is processed. The Data Management Subsystem (DMS) SI provides data storage and retrieval capability. A library of C++ classes implements the interfaces to these SIs as shown in Figure 2.

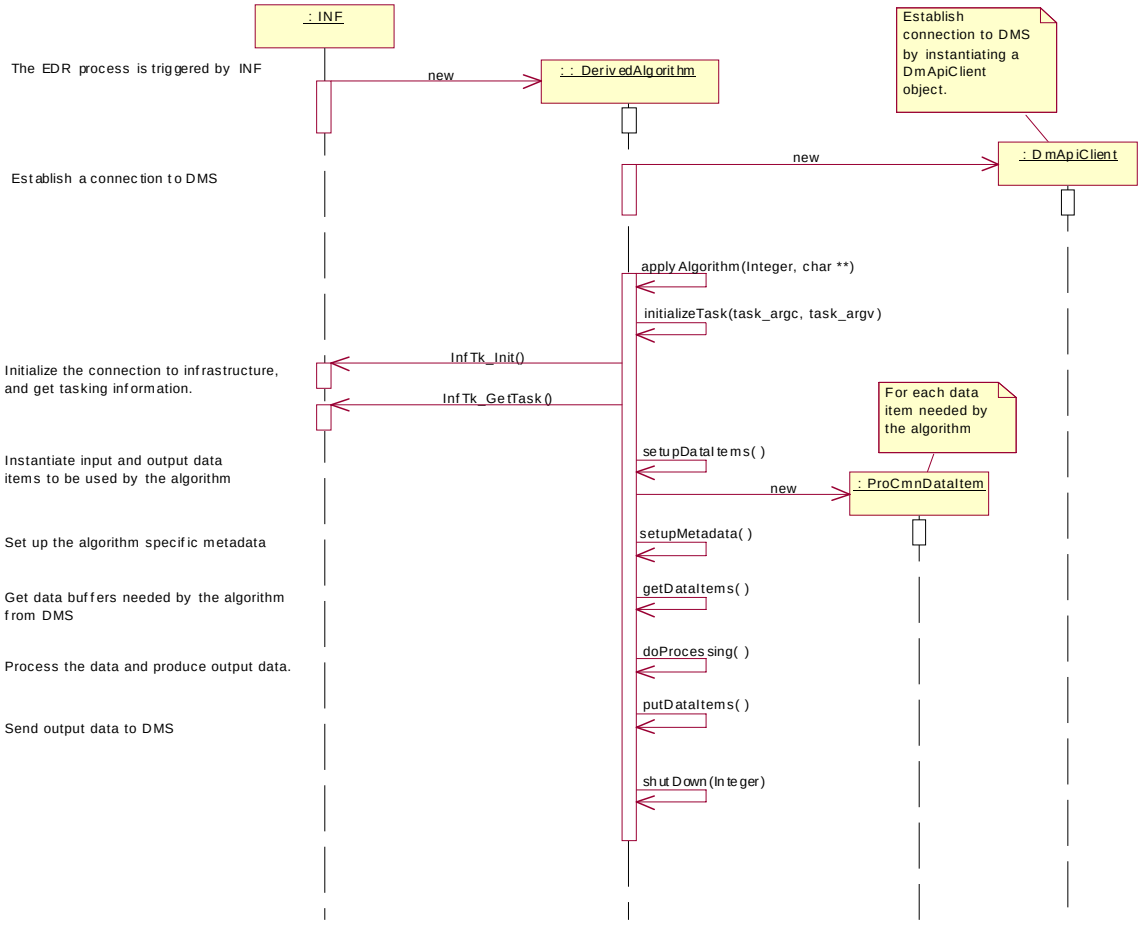

Figure 2. IPO Model Interface to INF and DMS

2.1.1.1 Inputs

The VIIRS Vegetation Index EDR requires: calibrated TOA reflectances (bands I1, I2) and Surface Reflectance (bands I1, I2, M3, Land Quality Flags).

VVI is calculated for all land retrievals with a solar zenith angle less than 85 degrees but is required to meet specification performance at angles less than 70 degrees. “Land” is allowed to include inland water bodies and rivers. Pixels labeled as “probably clear” or “probably cloudy” by the Surface Reflectance Land Quality Flags are processed but flagged accordingly. This same quality flag also indicates whether sufficient aerosol is present to warrant flagging the pixel as obscured, i.e., AOT>1. Table 3 describes the VVI EDR Inputs. Refer to the DPIS ICD, D35850, for a detailed description of the inputs.

Table 3. VVI EDR Inputs

Input	Type	Description	Units/Valid Range
Reflectance_Img	Float	Calibrated TOA Reflectances for band I1	Please refer to VIIRS Radiometric Calibration Document, D43777
Reflectance_Img	Float	Calibrated TOA Reflectances for band I2	Please refer to VIIRS Radiometric Calibration Document, D43777

Input	Type	Description	Units/Valid Range
VIIRS Surface Reflectance IP	Float	Surface Reflectance (TOC) for band I1	Please refer to D38697
VIIRS Surface Reflectance IP	Float	Surface Reflectance (TOC) for band I2	Please refer to D38697
VIIRS Surface Reflectance IP	Float	Surface Reflectance (TOC) for band M3	Please refer to D38697
VIIRS Surface Reflectance IP	Bytes	Land Quality Flags in moderate resolution 48-bit unsigned integer array	Please refer to D38697
VVI Retrieval Coefficients	Structure	Vegetation Index Coefficients for TOC EVI processing, I1, M3, and C	Please refer to Data Processor Inter-Subsystem Interface Control Document (DPIS ICD), D35850
VI DQTT	Structure	Reports erroneous pixels through a DQN	Performs a bitmask tests on LQFs

2.1.1.2 Outputs

The VVI EDR contains two fields that are written to the DMS in internal IDPS data format. Table 4 describes the VVI Output Contents. Refer to the DPIS ICD, D35850, for a detailed description of the outputs.

Table 4. VVI Output Contents

Output	Type	Description	Units/Valid Range
TOA_NDVI	Unsigned Integer	Top of Atmosphere (TOA) NDVI at imagery resolution	-1 to +1
TOC_EVI	Unsigned Integer	Top of Canopy (TOC) EVI at imagery resolution	-1 to +4
Byte 0 VVI EDR Quality Flags	Byte	Vegetative Index Quality Byte 0 Flags. See Table 5 for detailed description.	N/A
Byte 1 VVI EDR Quality Flags	Byte	Vegetative Index Quality Byte 1 Flags. See Table 6 for detailed description.	N/A
Byte 2 VVI EDR Quality Flags	Byte	Vegetative Index Quality Byte 2 Flags. See Table 7 for detailed description.	N/A
NDVI Scale	Float	NDVI scale factor	N/A
NDVI Offset	Float	NDVI offset	N/A
EVI Scale	Float	EVI scale factor	N/A
EVI Offset	Float	EVI offset	N/A
VVI DQN	Structure	This optional output item is only produced if an erroneous pixel is found during processing.	Please refer to Data Processor Inter-Subsystem Interface Control Document (DPIS ICD), D35850

Table 5. Byte 0 Quality Flag Structure

Byte	VIIRS VI Flag	Result	Bits
0	Overall NDVI Quality	1 = High 0 = Low NOTE: NDVI quality is set to high (1) if ALL of these conditions are met: 1) I1 TOA reflectance flag = avail 2) I2 TOA reflectance flag = avail 3) Cloud Confidence flag = confidently clear 4) Thin Cirrus flag = no thin cirrus 5) Solar Zenith Angle < 70 deg 6) Sun glint (Geometry based) = none	1
	Overall EVI Quality	1 = High 0 = Low NOTE: EVI quality is set to high (1) if ALL of these conditions are met: 1) I1 Surface reflectance flag = avail 2) I2 Surface reflectance flag = avail 3) M3 Surface reflectance flag = avail 4) Cloud Confidence flag = confidently clear 5) Thin Cirrus flag = no thin cirrus 6) Solar Zenith Angle < 70 deg 7) Sun glint (Geometry based) = none 8) EVI range flag = in range	1
	I1 TOA Reflectance	1 = Not Available 0 = Available	1
	I2 TOA Reflectance	1 = Not Available 0 = Available	1
	I1 Surface Reflectance	1 = Not Available 0 = Available	1
	I2 Surface Reflectance	1 = Not Available 0 = Available	1
	M3 Surface Reflectance	1 = Not Available 0 = Available	1
	EVI Range	1 = Out of Range 0 = In Range	1

Table 6. Byte 1 Quality Flag Structure

Byte	VIIRS VI Flag	Result	Bits
1	*Land/Water	101 = Coastal 011 = Sea Water 010 = Inland Water 001 = Land / No Desert 000 = Land & Desert	3
	*Cloud Confidence	11 = Confidently Cloudy 10 = Probably Cloudy 01 = Probably Clear 00 = Confidently Clear	2
	*Sun Glint	11 = Geometry & Wind 10 = Wind Speed Based 01 = Geometry Based 00 = None	2
	*Thin Cirrus	1 = Cloud 0 = No Cloud	1

*** Copied from Surface Reflectance IP**

Table 7. Byte 2 Quality Flag Structure

Byte	VIIRS VI Flag	Result	Bits
2	Stratification – Solar Zenith Angle	1 = 70 Degrees <= SZA <= 85 Degrees 0 = SZA < 70 Degrees or SZA > 85 Degrees	1
	*Excl – AOT > 1.0	1 = AOT > 1.0 0 = AOT <= 1.0	1
	Excl – Solar Zenith Angle > 85 Deg	1 = SZA > 85 degrees 0 = SZA <= 85 degrees	1
	Spare Bits	Initialized to 0	5

*** Copied from Surface Reflectance IP**

2.1.2 Algorithm Processing

This section provides a summary of the as-built VVI operational code. Figure 3 shows the Vegetation Index Data Flow.

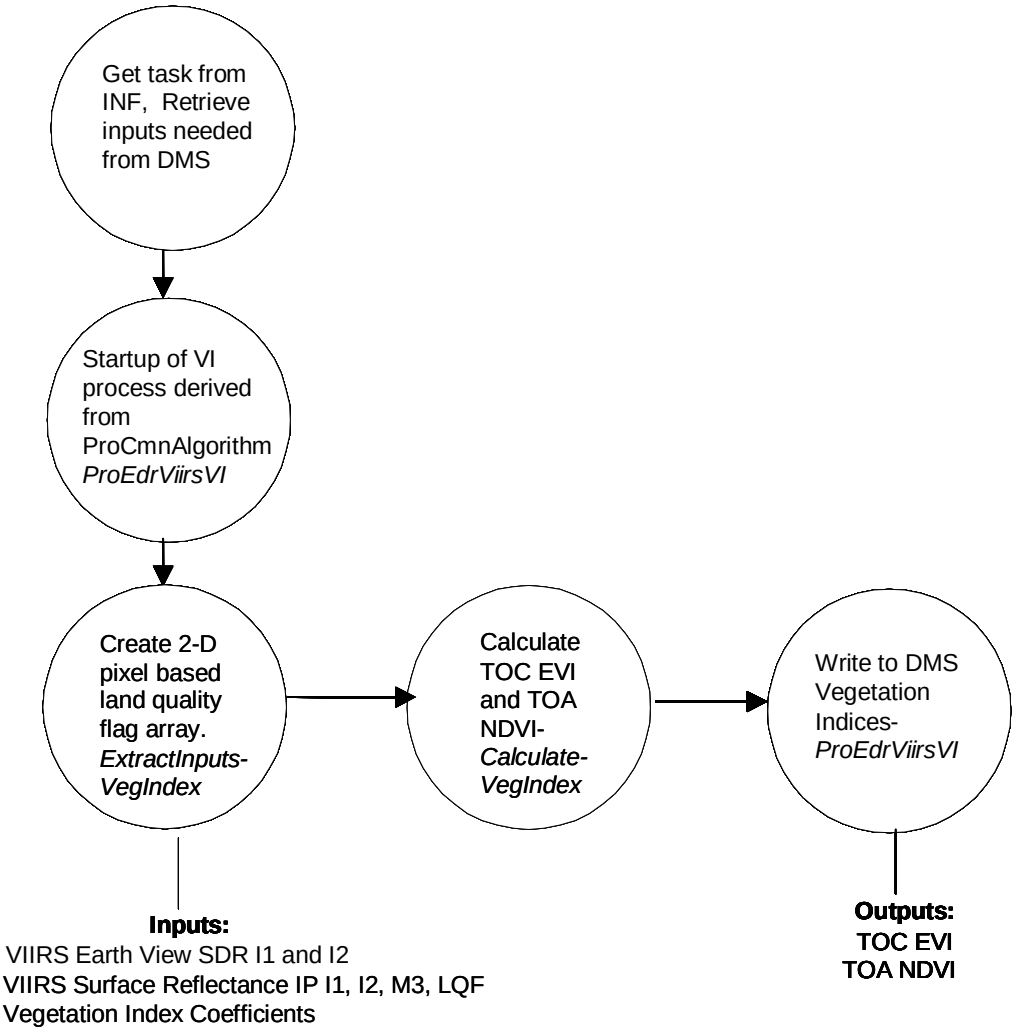

Figure 3. Data Flow Diagram of Overall VVI EDR Call Sequence from the Main Program

2.1.2.1 Main Module - ProEdrViirsVI.cpp

This is the Vegetation Index derived algorithm and is a subclass from the ProCmnAlgorithm of the common I/O design. ProEdrViirsVI creates a list of input data items that are read from DMS and passes all of the required data into the algorithm for processing. The input list includes a Vegetation Index Data Quality Threshold Table (DQTT) and the output includes a list of Data Quality Notifications if any were produced. When the algorithm has finished, the output data items are written to DMS. Refer to Figure 2 for a sequence diagram on this process.

2.1.2.2 Calculate_VegIndex

This function calculates: (1) the top of canopy EVI from VIIRS bands M3, I1, and I2 and (2) the top of atmosphere NDVI from VIIRS bands I1 and I2.

2.1.2.2.1 EVI

The following algorithm is used to calculate the top of canopy EVI:

TOC EVI = (1 + VegIndex_Coeffs.EVI)*(SurfReflect.I2 – SurfReflect.I1)/ (SurfReflect.I2 + VegIndex _Coeffs.EVI.I1* SurfReflect.I1 – VegIndex_Coeffs.EVI.M3 * SurfReflect.M3 + VegIndex_Coeffs.EVI)

Where VegIndex_Coeffs.EVI are unitless coefficients used to compute EVI. EVI ranges from -1 to 4; pixels with EVI values outside of this range are assigned a fill value of 65535.

Note that under thin cirrus conditions for a given pixel no Surface Reflectance IP value is produced and so accordingly no EVI may be computed.

2.1.2.2.2 NDVI

The following algorithm is used to calculate the top of atmosphere NDVI:

TOA NDVI = (TOAReflect.I2 – TOAReflect.I1) / (TOAReflect.I2 + TOAReflect.I1)

NDVI ranges from -1 to 1; pixels with NDVI values outside of this range are assigned a fill value of 65535.

2.1.3 Graceful Degradation

2.1.3.1 Graceful Degradation Inputs

There is one case where input graceful degradation is indicated in the Vegetation Index EDR

1. An input retrieved for the algorithm has its N_Graceful_Degradation metadata field set to YES (propagation)

2.1.3.2 Graceful Degradation Processing

None.

2.1.3.3 Graceful Degradation Outputs

None.

2.1.4 Exception Handling

- Software was added to check for divide by zero situations for TOA NDVI and TOC EVI.
- Pixels trimmed Onboard and Onground are not processed.
- NDVI is not calculated if Calibrated Reflectance I1 or I2 contain FILL value. NDVI is instead set to a FILL value.
- EVI is not calculated if Surface Reflectance I1, I2, or M3 contain FILL value. EVI is instead set to a FILL value.

2.1.5 Data Quality Monitoring

Each algorithm uses specific criteria contained in a Data Quality Threshold Table (DQTT) to determine when a Data Quality Notification (DQN) is produced. The DQTT contains the threshold used to trigger the DQN as well as the text contained in the DQN. If a threshold is met, the algorithm stores a DQN in DMS indicating the test(s) that failed and the value of the DQN attribute. For more algorithm specific detail refer to the CDFCB-X, D34862.

2.1.6 Computational Precision Requirements

The VVI algorithm requires input items to be a combination of 32-bit floating-point precision values and unsigned 8-bit integers. The 32-bit floating-point precision items are VIIRS Calibrated TOA Reflectances (bands I1, I2), VIIRS Surface Reflectance IP (bands I1, I2, M3),

and the VVI coefficients. The unsigned 8-bit integer item is the Land Quality Flags from the moderate surface reflectance.

The output values of the algorithm are unsigned 16-bit integers with a measurement precision of 0.0002 NDVI units.

2.1.7 Algorithm Support Considerations

- DMS should be up and running. All the data (primary or secondary) needed for the VVI calculations must be available in the DMS for the successful completion of the process.
- INF must be running so the process can retrieve the tasks send messages to INF upon successful completion or failure to complete the process.
- A C++ compiler is necessary to compile the VVI source code.
- The PRO Common library is available.
- The imake files can create the Makefile used to compile VVI.

2.1.8 Assumptions and Limitations

2.1.8.1 Assumptions

- The baseline software assumes co-registration exists between the channels, and assumes nesting of the imagery pixels around the moderate pixels.

2.1.8.2 Limitations

- Retrievals are not performed under nighttime conditions. This is defined as instances where the solar zenith angle exceeds 85 degrees.
- Retrievals are not performed under confident cloudy conditions.
- Retrievals are not performed over ocean surfaces.
- Retrievals of EVI and other surface parameters are questionable under conditions of extreme aerosol loading, such as events associated with volcanic eruptions or biomass burning, and retrievals of EVI over snow are not guaranteed to meet the performance specification.
- If for any reason the TOA or Surface Reflectance data is not available in DMS, the Vegetation Index algorithm is not performed.

3.0 GLOSSARY/ACRONYM LIST

3.1 Glossary

The current glossary for the NPOESS program is D35836_G_NPOESS_Glossary. Table 8 contains those terms most applicable for this OAD.

Table 8. Glossary

Term	Description
Algorithm	A formula or set of steps for solving a particular problem. Algorithms can be expressed in any language, from natural languages like English to mathematical expressions to programming languages like FORTRAN. On NPOESS, an algorithm consists of: 1. A theoretical description (i.e., science/mathematical basis) 2. A computer implementation description (i.e., method of solution) 3. A computer implementation (i.e., code)
Algorithm Configuration Control Board (ACCB)	Interdisciplinary team of scientific and engineering personnel responsible for the approval and disposition of algorithm acceptance, verification, development and testing transitions. Chaired by the Algorithm Implementation Process Lead, members include representatives from IWPTB, Systems Engineering & Integration IPT, System Test IPT, and IDPS IPT.
Algorithm Verification	Science-grade software delivered by an algorithm provider is verified for compliance with data quality and timeliness requirements by Algorithm Team science personnel. This activity is nominally performed at the IWPTB facility. Delivered code is executed on compatible IWPTB computing platforms. Minor hosting modifications may be made to allow code execution. Optionally, verification may be performed at the Algorithm Provider's facility if warranted due to technical, schedule or cost considerations.
EDR Algorithm	Scientific description and corresponding software and test data necessary to produce one or more environmental data records. The scientific computational basis for the production of each data record is described in an ATBD. At a minimum, implemented software is science-grade and includes test data demonstrating data quality compliance.
Environmental Data Record (EDR)	*[IORD Definition]* Data record produced when an algorithm is used to convert Raw Data Records (RDRs) to geophysical parameters (including ancillary parameters, e.g., cloud clear radiation, etc.). *[Supplementary Definition]* An Environmental Data Record (EDR) represents the state of the environment, and the related information needed to access and understand the record. Specifically, it is a set of related data items that describe one or more related estimated environmental parameters over a limited time-space range. The parameters are located by time and Earth coordinates. EDRs may have been resampled if they are created from multiple data sources with different sampling patterns. An EDR is created from one or more NPOESS SDRs or EDRs, plus ancillary environmental data provided by others. EDR metadata contains references to its processing history, spatial and temporal coverage, and quality.
Model Validation	The process of determining the degree to which a model is an accurate representation of the real-world from the perspective of the intended uses of the model. [Ref.: DoDD 5000.59-DoD Modeling and Simulation Management]
Model Verification	The process of determining that a model implementation accurately represents the developer's conceptual description and specifications. [Ref.: DoDD 5000.59-DoD Modeling and Simulation Management]
Operational Code	Verified science-grade software, delivered by an algorithm provider and verified by IWPTB, is developed into operational-grade code by the IDPS IPT.
Operational-Grade Software	Code that produces data records compliant with the System Specification requirements for data quality and IDPS timeliness and operational infrastructure. The software is modular relative to the IDPS infrastructure and compliant with IDPS application programming interfaces (APIs) as specified for TDR/SDR or EDR code.

Term	Description
Raw Data Record (RDR)	*[IORD Definition]* Full resolution digital sensor data, time referenced, with absolute radiometric and geometric calibration coefficients appended, but not applied, to the data. Aggregates (sums or weighted averages) of detector samples are considered to be full resolution data if the aggregation is normally performed to meet resolution and other requirements. Sensor data shall be unprocessed with the following exceptions: time delay and integration (TDI), detector array non-uniformity correction (i.e., offset and responsivity equalization), and data compression are allowed. Lossy data compression is allowed only if the total measurement error is dominated by error sources other than the data compression algorithm. All calibration data will be retained and communicated to the ground without lossy compression. *[Supplementary Definition]* A Raw Data Record (RDR) is a logical grouping of raw data output by a sensor, and related information needed to process the record into an SDR or TDR. Specifically, it is a set of unmodified raw data (mission and housekeeping) produced by a sensor suite, one sensor, or a reasonable subset of a sensor (e.g., channel or channel group), over a specified, limited time range. Along with the sensor data, the RDR includes auxiliary data from other portions of NPOESS (space or ground) needed to recreate the sensor measurement, to correct the measurement for known distortions, and to locate the measurement in time and space, through subsequent processing. Metadata is associated with the sensor and auxiliary data to permit its effective use.
Retrieval Algorithm	A science-based algorithm used to 'retrieve' a set of environmental/geophysical parameters (EDR) from calibrated and geolocated sensor data (SDR). Synonym for EDR processing.
Science Algorithm	The theoretical description and a corresponding software implementation needed to produce an NPP/NPOESS data product (TDR, SDR or EDR). The former is described in an ATBD. The latter is typically developed for a research setting and characterized as "science-grade".
Science Algorithm Provider	Organization responsible for development and/or delivery of TDR/SDR or EDR algorithms associated with a given sensor.
Science-Grade Software	Code that produces data records in accordance with the science algorithm data quality requirements. This code, typically, has no software requirements for implementation language, targeted operating system, modularity, input and output data format or any other design discipline or assumed infrastructure.
SDR/TDR Algorithm	Scientific description and corresponding software and test data necessary to produce a Temperature Data Record and/or Sensor Data Record given a sensor's Raw Data Record. The scientific computational basis for the production of each data record is described in an Algorithm Theoretical Basis Document (ATBD). At a minimum, implemented software is science-grade and includes test data demonstrating data quality compliance.
Sensor Data Record (SDR)	*[IORD Definition]* Data record produced when an algorithm is used to convert Raw Data Records (RDRs) to calibrated brightness temperatures with associated ephemeris data. Temperature Data Records (TDRs) are geolocated, antenna temperatures with all relevant calibration data counts and ephemeris data to revert from T-sub-a into counts. The existence of the SDRs provides reversible data tracking back from the EDRs to the Raw data. *[Supplementary Definition]* A Sensor Data Record (SDR) is the recreated input to a sensor, and the related information needed to access and understand the record. Specifically, it is a set of incident flux estimates made by a sensor, over a limited time interval, with annotations that permit its effective use. The environmental flux estimates at the sensor aperture are corrected for sensor effects. The estimates are reported in physically meaningful units, usually in terms of an angular or spatial and temporal distribution at the sensor location, as a function of spectrum, polarization, or delay, and always at full resolution. When meaningful, the flux is also associated with the point on the Earth geoid from which it apparently originated. Also, when meaningful, the sensor flux is converted to an equivalent top-of-atmosphere (TOA) brightness. The associated metadata includes a record of the processing and sources from which the SDR was created, and other information needed to understand the data.

Term	Description
Temperature Data Record (TDR)	*[IORD Definition]* Temperature Data Records (TDRs) are geolocated, antenna temperatures with all relevant calibration data counts and ephemeris data to revert from T-sub-a into counts. *[Supplementary Definition]* A Temperature Data Record (TDR) is the brightness temperature value measured by a microwave sensor, and the related information needed to access and understand the record. Specifically, it is a set of the corrected radiometric measurements made by an imaging microwave sensor, over a limited time range, with annotation that permits its effective use. A TDR is a partially-processed variant of an SDR. Instead of reporting the estimated microwave flux from a specified direction, it reports the observed antenna brightness temperature in that direction.

3.2 Acronyms

The current acronym list for the NPOESS program, D35838_G_NPOESS_Acronyms, can be found on eRooms. Table 9 contains those terms most applicable for this OAD.

Table 9. Acronyms

Term	Expansion
AM&S	Algorithms, Models & Simulations
API	Application Programming Interfaces
ARP	Application Related Product
CDFCB-X	Common Data Format Control Book - External
DMS	Data Management Subsystem
DPIS ICD	Data Processor Inter-subsystem Interface Control Document
EVI	Enhanced Vegetation Index
GMVI	Gridded Monthly Vegetation Index
GVI	Global Vegetation Index
GWVI	Gridded Weekly Vegetation Index
INF	Infrastructure
ING	Ingest
IP	Intermediate Product
LAI	Leaf Area Index
LUT	Look-Up Table
MDFCB	Mission Data Format Control Book
MVI	MODIS Vegetation Index
NDVI	Normalized Difference Vegetation Index
QF	Quality Flag
SAVI	Soil Adjusted Vegetation Index
SDR	Sensor Data Record
SI	International System of Units
TBD	To Be Determined
TBR	To Be Resolved
TOA	Top of the Atmosphere
VVI	VIIRS Vegetation Index
VVI2P	VIIRS Vegetation Index Secondary Products
VVI3P	VIIRS Vegetation Index Tertiary Products
WVI	Weekly Vegetation Index

4.0 OPEN ISSUES

Table 10. TBXs

TBX ID	Title/Description	Resolution Date
None		